1 - Introducing Meshes and Z-Modeler

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To begin, we must discuss some fundamentals of creating a virtual environment. In order to create a fully 3D environment, you have to have some kind of framework that exists in a 3D space. This framework is the fundamental part of 3D modeling. We call it the mesh or the model. Objects in the real world have surfaces, shapes, contours, and dimensions. These surfaces are translated into the mesh of a 3D scene. On the computer screen, we can see only two dimensions. The 3D Accelerator in our computer translates a 3D scene into a 2-Dimensional image that is displayed on the screen. This process is called rendering. The computer considers the position of the camera with relation to the scene, and shows us the scene from that angle. It may seem simple, and indeed it is simple to draw a picture on the screen, but the difference is that with a 3D scene, we can easily rotate the camera to the other side of the scene and see what it looks like from the other side. So, you can see then that the primary means of constructing a 3D scene is making that framework, those surfaces, that *mesh* that defines the scene. This is what Z-Modeler does. This chapter will introduce you to both meshes and Z-Modeler at the same time. As with the rest of this document, I recommend that you keep Z-Modeler open while you read it.

Mesh Concepts

The first subjects we must discuss are the components that make up a mesh. I will present meshes in this guide as polygon objects. Though there are other ways to make meshes (for example, NURBS, NURMS, etc), Z-Modeler only deals with polygon objects. Indeed, most games today only deal with polygon models because of the accuracy, and speed of rendering that they entail.

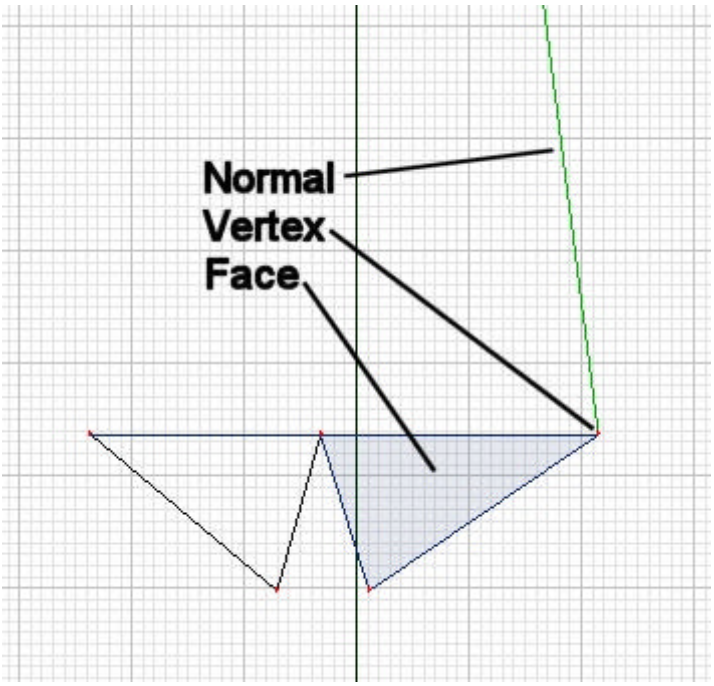
So what is that mesh made up of? Basically, there are components to a mesh. Starting from the largest to the smallest, there is the *Object,* the *Face*, the *Edge*, and the *Vertex.* A mesh is made up of many points or Vertices in a three-dimensional plane, all connected by Edges, and these edges make up *polygons*. This is also sometimes known as the Face, as it is referred to in Z-Modeler. The most common way to construct a mesh is to position triangle-shaped faces or polygons in a 3D coordinate system. The polygons, or polies, are connected together to make surfaces, or Objects. You can change the shape, size, and angle of one or more polies by manipulating the vertices that border that face. You can also do manipulations with one of the three Edges of any polygon. So you can see that the major portions of your model are the objects. The objects are made up of faces, which each have three edges and three verts. As you go from Objects to Verts, you increase the precision with which you can shape your mesh. The function of objects is to model real-world objects. For example, if modeling a car, you might have an object that is the taillight, and a separate one for the windshield. Any of the different parts of the mesh (Verts, Edges, Faces, and Objects) are collectively called elements. There is another element of the mesh, however.

Additionally, each vertex in a mesh has a *normal* assigned to it. The normal is not an independent element, but is more like a property for each vertex. The normal defines how light is reflected on the vertex (and it's surrounding faces). A normal is represented in Z-Modeler by a green line extending from the vertex it is associated with. Depending on which way the normal points, your faces will be shaded differently. The normal is usually described as it relates, not to the vertex, but the faces around that vertex. In general, if the normal is on the side of the surface that shows (in other words, pointing away from the surface), the surface will be lit normally. Conversely, when a normal is on the inside of a surface, pointing inside the surface, the surface has a darkened look, and this is not usually desirable. This is all that you really need to know about normals for the moment. Later, we will devote an entire chapter to the discussion of Normals. They have a huge impact on the realism and quality of your mesh.

Meshes in Z-Modeler

In order to create a 3D mesh, we have to translate input from the mouse and the keyboard into a three-dimensional surface. This is no easy task. The way that we do this is by using different views of the mesh to shape it, and then we can view it from a camera perspective to check our work. This is the basis of modeling. Translating from a flat surface to a 3D surface is called extrusion, and it is a major concept of modeling. We will deal with this later. For now, however, you need to be familiar with the User Interface of Z-Modeler. Let's deal with how the different elements of a mesh are displayed and represented in Z-Modeler.

Elements



In Z-Modeler, Vertices are represented by red dots, faces are shown as black lines connecting those dots, and normals are green lines. See the picture to the right. How do we control these different elements?

Control Levels

One concept that you must master is that of Control Levels. You don't always want to affect your entire surface, at times you want to control a single vertex to move it, scale it with regard to the axis, or delete it. You may want to do the same with a face, or even the edge connecting two faces. For this reason you have what I call *Control Levels* in Z-Modeler. These determine whether you are modifying Verts, Edges, Faces, or whole Objects. Those are listed in a kind of ascending order. When working on the Vert level, you are modifying the smallest part of your mesh. When you modify Edges, you modify at least two verts and their connected faces. When you work on faces, you are affecting 3 verts. And with objects you modify every single vert, face, and edge in your object. To switch between the control levels, use the keyboard buttons 1, 2, 3 and 4, respectively. You can also switch with these buttons, found on the standard toolbar. I've highlighted the level selectors in the following picture.

Now, switching between levels is pretty much automatic, but you have to understand the idea that the three levels Vert, Edge, and Face exist inside of *each object*. So, to switch from Object to any other mode, you have to select the mode either with the keyboard or the buttons, then you have to left-click the object you want to "get inside," so to speak. Once "inside" an object, you can switch between the levels other than Object without clicking any other objects. It's a simple concept once you get used to it. To take a sample action step-by step:

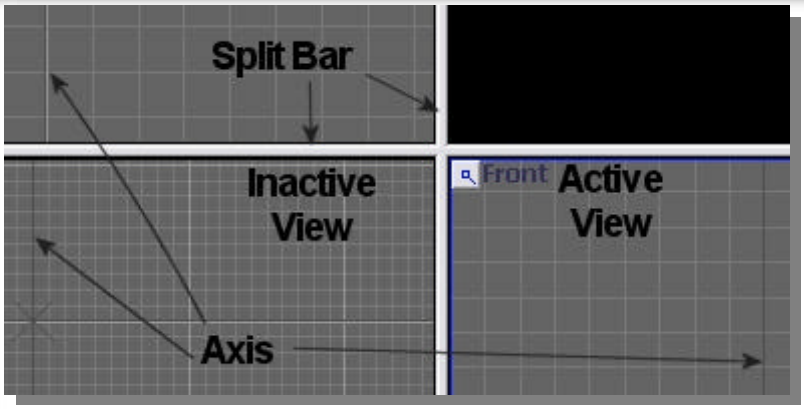
Switching from Object to Vert mode.

1. Make sure the object mode is on. (it's button is depressed)
2. Click the Vert mode Button
3. Click the object you wish to edit.

Views

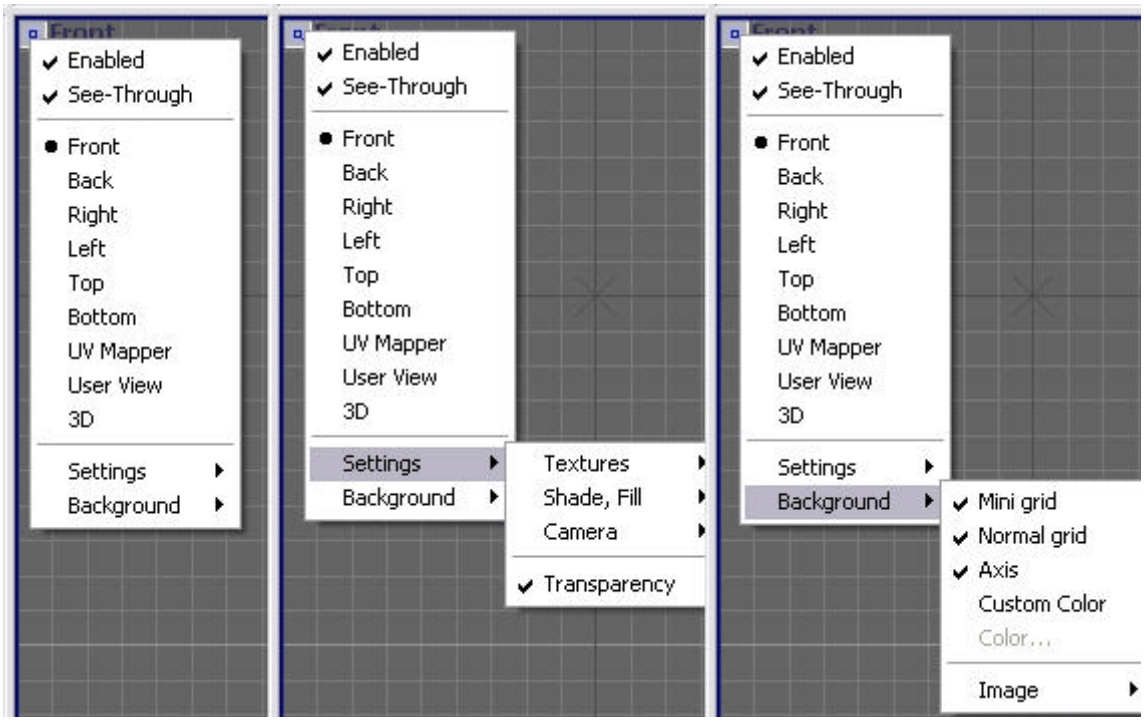
As stated earlier, the views in Z-Modeler are crucial to making a 3D surface. To that end, working with views is one of the prime things about Z-Modeler. If you're not zooming in tight enough, your meshes will not be as accurate or detailed. If you're blinded by overly small mini-grid lines, then you'll give up. If you can't rotate and zoom in on your mesh, you'll be bewildered and won't extrude or map it properly. . . the list goes on.

So the views in Z-Modeler are laid out like this: The main window is split into four panes, the size of which can be changed. The vertical and horizontal split bars can be drug to the right or left, up and down, to give you a larger view of one window over the other. Perhaps the greatest tool when working with views is the Asterisk key (*) on your numeric keypad. Views are either *active* or *inactive.* Only one active view is possible at a time. The active view is the view that you will be editing the mesh in. Any changes you make are *relative to that view*. So, if you move a vert to the right in the front view, it will not be the same as if you move it to the right in the left view. Different views allow us to move verts in ways that we couldn't with just one view. For example, moving a vert to the right in the front view has no discernible effect in the left view, but it does have an effect, and you can see it move in the top and 3D views. This is a difficult concept to explain but you have to understand this manner of thinking before you can master 3D modeling. You can tell which view is active, because there will be a blue border around it. See the picture on the next page.



You'll also notice the *Axis* in the picture. The axis represents the center of your model and it is a reference point.

With Z-Modeler, you're not limited to merely one preset group of views. The views are fully customizable in almost every way. Each view pane has a button at the top-left which, when clicked or right clicked, brings up a menu:



This is a very important menu, as it allows you to control your user environment to a great degree. The commands are summarized in the table on the following page.

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Before we leave Views, let's talk about the three special views available, the UV Mapper, the 3D View, and the User View. These views are intrinsic to making good models and are easy to work. Your UV Mapper view works like a regular view, except there is no grid, and you cannot control the Background Image. Mapping, and using the UV Mapper Window will be discussed later. The 3D View shows you a 3-Dimensional representation of the mesh you are creating. It gives you perspective. You left-click and move the mouse around to spin your view of the objects, and you right-click and move the mouse up and down to zoom in. You can pan the view back and forth by holding both mouse buttons and moving the mouse. No editing is possible in the 3D view.

The User View is much like the 3D view, except that it allows you to edit the mesh within that view. However, you must switch to absolute editing mode before you can modify the mesh in the view. More on that later. Rotating, panning, and zooming the view are the same as with the 3D view, except that you have to hold down the Alt Button on your keyboard while doing so. Now that we've discussed how to control your user environment, you now have to understand how your elements react to that environment.

Mesh States

The elements of your 3D scene must have some basic attributes for you to be able to modify them. In fact, each Object, face, edge, or vertex has 4 attributes at any given time. The state of your element is described as either Enabled or Disabled, Active or Inactive, Selected or Deselected, and Hidden or Displayed. With the exception of Enabled/Disabled, you can apply any of these states to an object, a face, an edge, or a vertex.

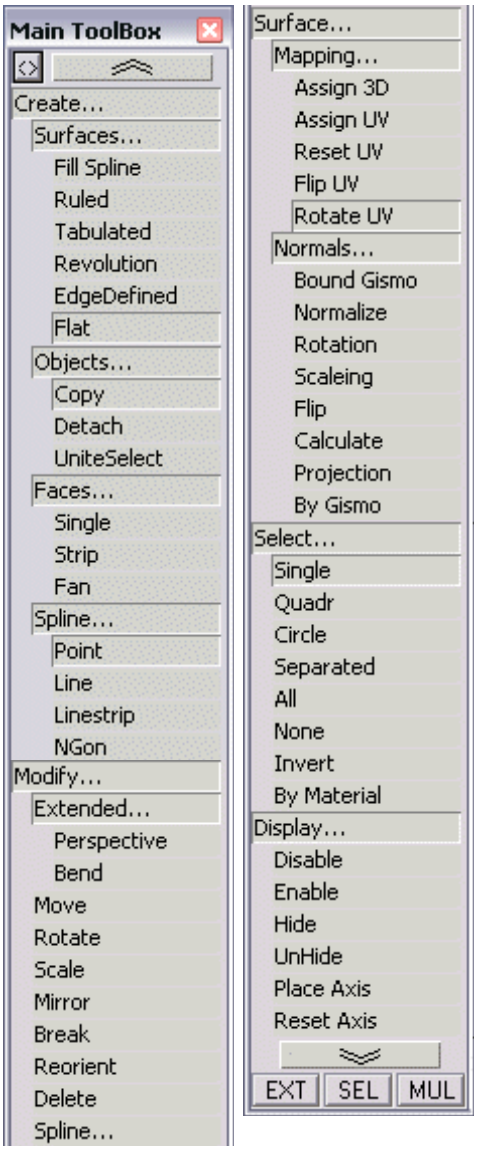
- *Enabled* objects are simply objects that can be modified. Objects that are *Disabled* can be viewed, but they are exempt from any kind of editing. Disabled objects appear as lighter gray in the views and as normal in the 3D view. Objects are Enabled by default.
- *Active* objects are ones that are either currently being edited, or simply, the object which the mouse is hovering over. Active objects appear to glow bright blue. *Inactive* elements are just the opposite. They are not being edited, or are elements not currently highlighted by the mouse.
- *Selected* Objects are objects that are set aside for some special purpose. We will learn more about why selecting objects is profitable in the next chapter. Selected objects are shown as red or orange, and they really light up when you hover the mouse over them, glowing bright red. This means that they are Active and Selected. Again, *Deselected* objects are just the opposite.
- *Hidden* objects can't be seen, and that's a silly statement. What needs to be brought out though, is the benefit of hiding verts and/or faces within an object. This is a very useful technique if your verts or faces from another part of a mesh are getting in the way. The concept of *Unhidden* objects is even more obvious: You can see them.

Next we need to look at how to navigate Z-Modeler's commands.

Accessing Z-Modeler's Commands

Perhaps the most bewildering aspect of Z-Modeler, at least for the uninitiated, is the fact that commands are distributed in several places: Toolboxes, Toolbars, and Menus. Generally, the most important tools are kept in the Toolboxes, and the least important commands are found on the menus.

Toolboxes hold the most of the commands you'll use, and most of those commands are held in the Main Toolbox. This toolbox is a paragon of efficiency. Have a look at everything it holds: (note: it's impossible to show this actually inside Z-Modeler.) Contained here are the commands you will use to modify, create, select, and display your meshes. It contains a remarkable amount of data in a small, compact design. See the picture on the following page.



Note: With reference to nomenclature, we will by default reference each tool in the toolbox in the following way. Because of the layered nature of the toolbox, we will reference the top-level section, then any middle sections, and then the tool itself. In this text I will bold them and separate each field by an arrow like so: ***Top Level→Middle→Command****. An example is* ***Create→Faces→Single****. This is for clarity. When working in Z-Modeler you'll eventually think something along the lines of "OK, now I want Modify . . . Extended . . . Bend." Then you will have reached the highest level of "Z-Modeler Junkie".*

The Main Toolbox is supplemented by the Objects toolbox, which provides a list of all the objects, and allows you to perform some basic functions on them. This toolbox has several buttons and a helpful right-click menu, both shown below.

Next are the toolbars. Most of the toolbar commands have to do with viewing, file handling, and user-interface, but there are some vital tools here as well. They can all be seen here:

The menus are fairly universal, though some very vital tools are stored here as well.

That wraps up our introduction to meshes, Z-Modeler's interface, and basic concepts. Our next chapter will discuss how to execute all those commands you have just learned how to find.